(12) UK Patent Application (19) GB (11) 2 082 961 A

(21) Application No 8121856
(22) Date of filing 15 Jul 1981
(30) Priority data
(31) 68130
67181
(32) 16 Jul 1980
10 Feb 1981
(33) Italy (IT)
(43) Application published
17 Mar 1982
(51) INT CL³
B29D 31/00
(52) Domestic classification
B5A 1R214B 1R314C12
1R314C1C 1R314C1E
1R314C1F 1R314C5
1R422 20T14 20T16 A1
(56) Documents cited
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GB 1028047
(58) Field of search
B5A

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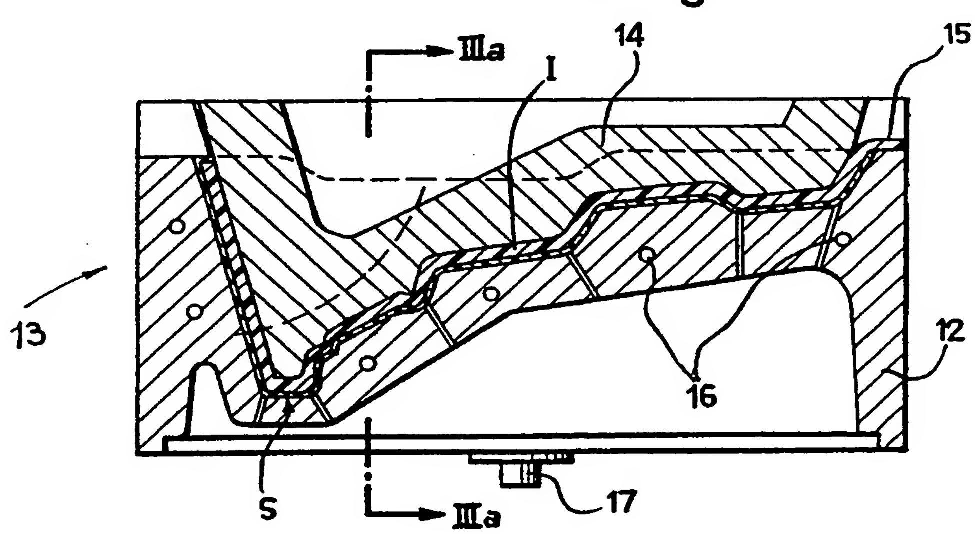
(54) Self-supporting element useful in the construction of motor vehicle body interiors, particularly in the form of an instrument panel, and a method of manufacturing it

(57) The element comprises, in intimate interconnection, a self-supporting polymeric insert (*I*) and a heat deformable soft surface layer (*S*) including a foam half-layer. A method comprises the steps of vacuum forming the surface layer (*S*) on a mould plug, transferring the preformed layer into a corresponding female mould (12), closing the split mould, and forming the self-supporting insert (*I*) by injection of a rigid polyurethane two-component material. In another method the insert is injection moulded, its surface rendered tacky, and the surface layer vacuum formed onto it.

Fig. 3



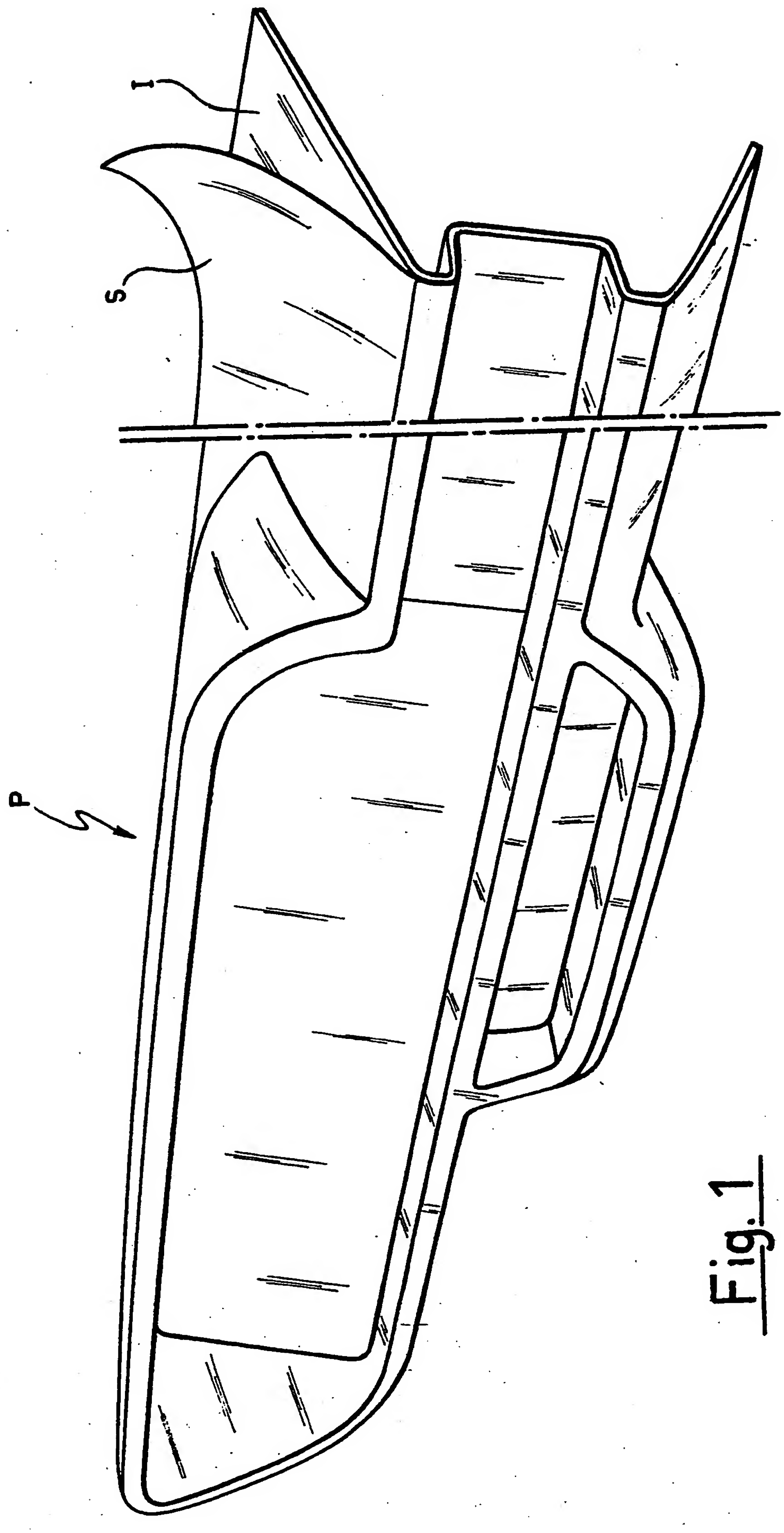


Fig. 1

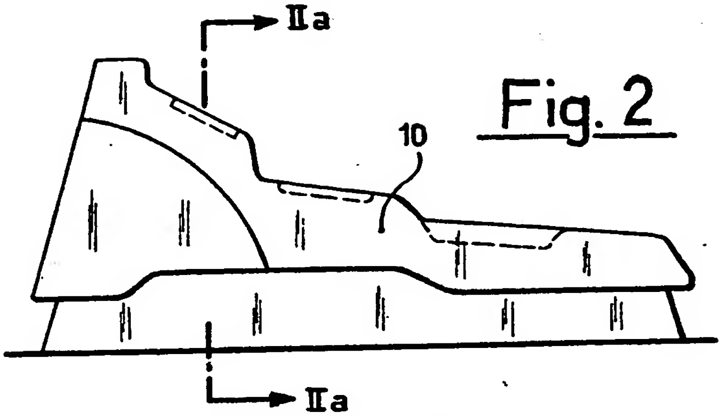


Fig. 2

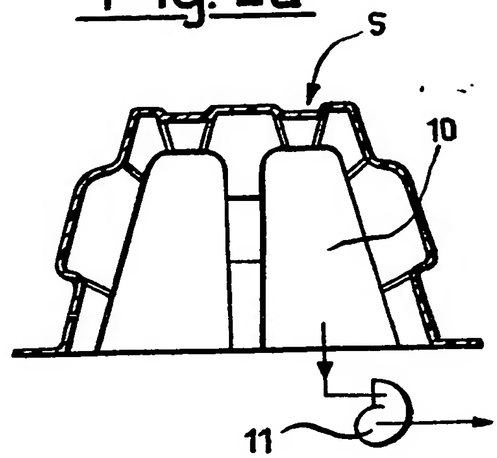


Fig. 2a

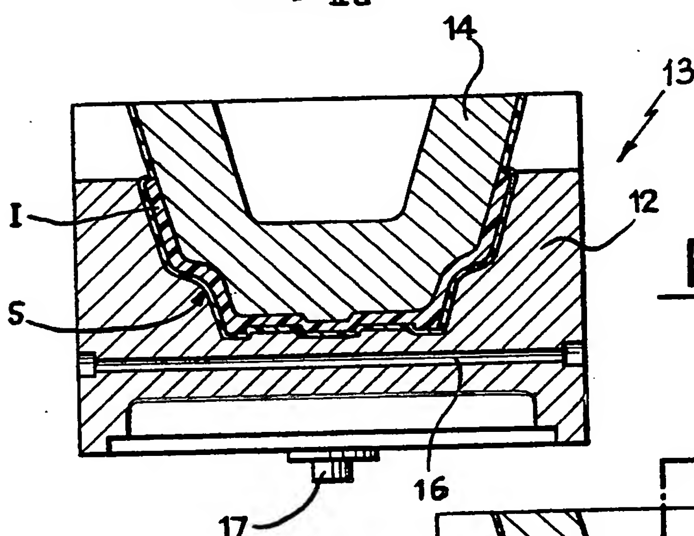


Fig. 3a

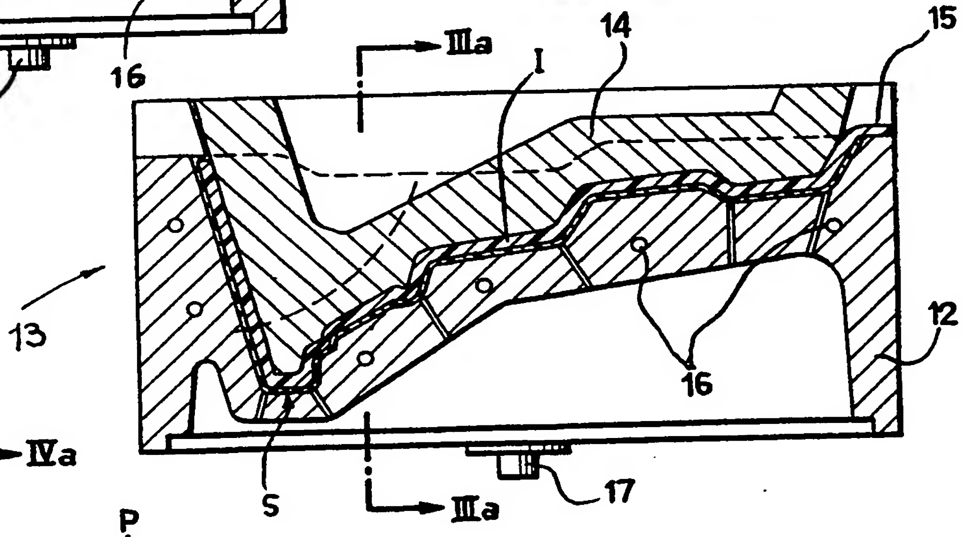


Fig. 3

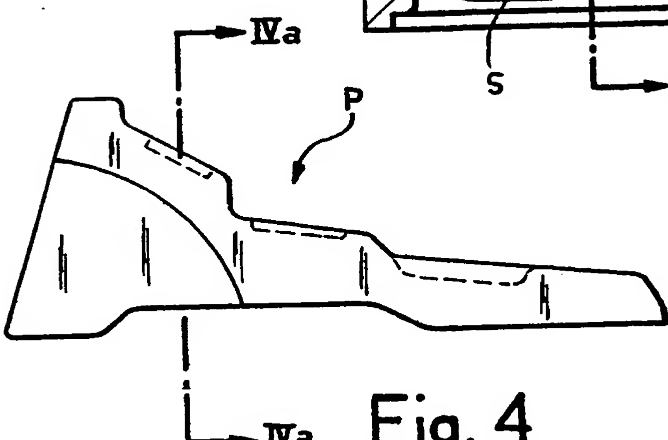


Fig. 4

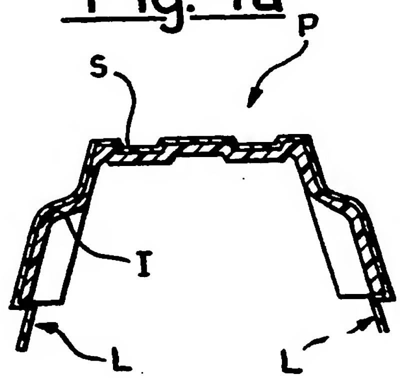
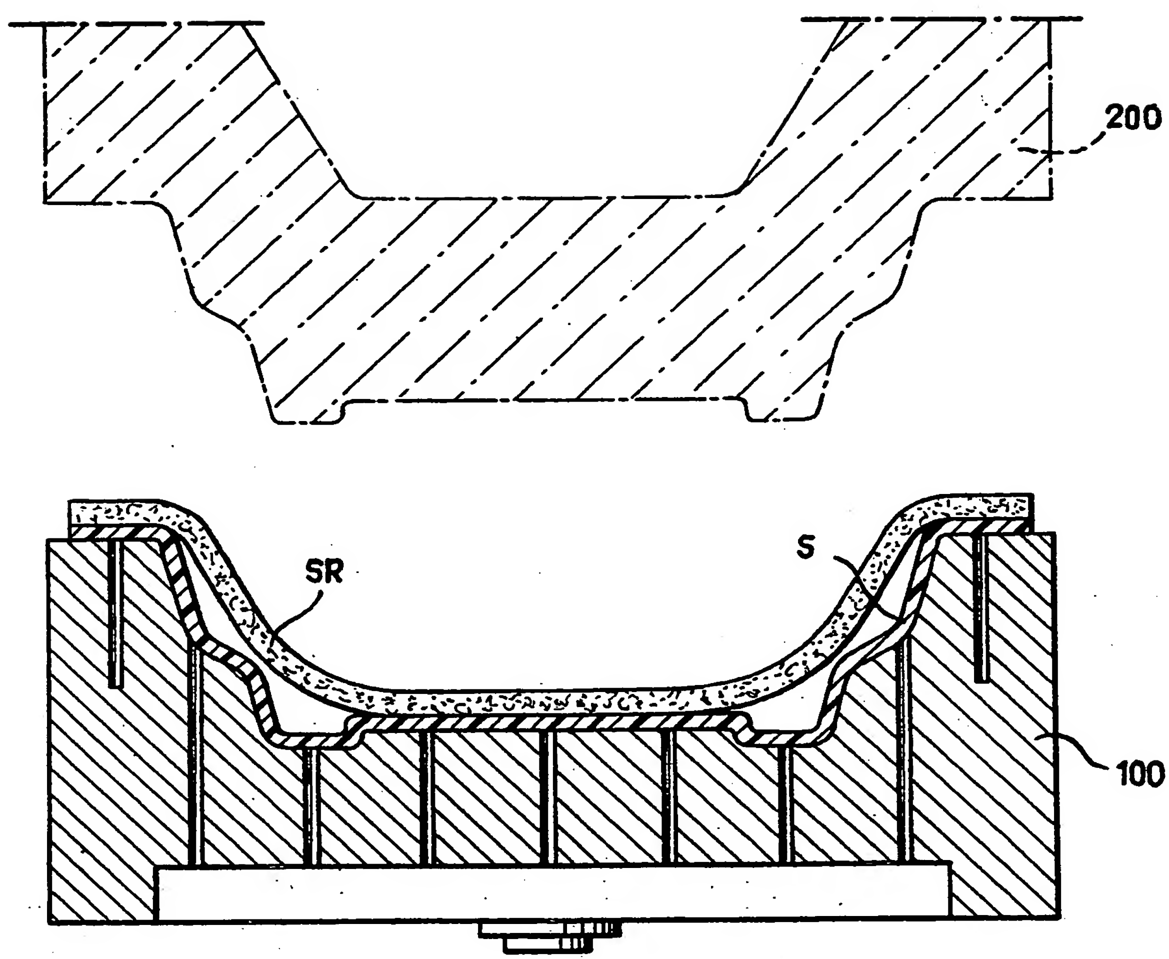


Fig. 4a

Fig. 5



SPECIFICATION

Self-supporting element useful in the construction of motorv hicl body int riors, particularly in the form of an instrument panel, and a method of manufacturing it

This invention relates to self-supporting lements useful in the construction of motorvehicle body interiors, particularly as the instrument panel or dashboard therefor, or rigid pouches or general purpose storage boxes or lockers, such as are usually provided along the sides and on the floor of a vehicle body interior.

This invention sets out to provide an element as indicated, which combines those characteristics of rigidity which are necessary to ensure self-supporting capabilities with a surface softness which improves substantially the vehicle interior comfort, increases its safety, and imparts to the element a pleasing outward appearance.

Within that general aim, it is possible to arrange that the element of this invention, where in the form of an instrument panel or dashboard elements, can complement the functional and aesthetic features mentioned above with an appreciable simplification of its manufacturing process, thus becoming specially suitable for mass production methods.

According to one aspect of the present invention, there is provided a self-supporting element, particularly in the form of an instrument panel for motorvehicle interiors, characterised in that it comprises, in intimate mutual inter-connection, a self-supporting polymeric insert and a soft surface layer including a heat-deformable laminate, in turn made up of a rolled half-layer and foam half-layer coupled together.

According to another aspect of the present invention, there is provided a manufacturing method, characterised in that it comprises the following steps:

heat forming under vacuum a surface layer on a thermally conditioned mould plug;

transferring said pre-formed layer into a corresponding female mould;

closing said mould; and

forming said insert by direct injection of a rigid polyurethane two-component material in accordance with the reaction injection moulding (R.I.M.) procedure.

According to a further aspect of the present invention, there is provided a manufacturing method, characterised in that is comprises the following steps:

forming a polypropylene insert by injection moulding, said insert being in the form of a patterned plate with throughgoing holes;

tackifying, by means of a primer r by flame application and polyur than adhesive, that face of the insert which is int nded for rec iving a surface layer thereon; and

applying, by vacuum forming, a surface layer t said insert, while utilising said insert as a mould plug for said surface layer.

The surface layer, preferably including a half-layer made up of a rolled sheet formed from a mixture of such materials as "ABS" (acrylonitrile-butadiene-styrene) and "PVC" (polyvinyl chloride), and a foam or expanded PVC cross-linked polyethylene half-layer, is obtained by coupling said half-layers together as by rolling and following the tackifying of at least one of said half-layers. A technique for the formation of said surface layer is disclosed in the Italian Patent Application No. 67120 A/80 by the same Applicant.

According to yet another advantageous aspect of the invention, between the shell defining the external layer and the self-supporting polymeric structure, there is interposed a reinforcing layer, substantially and preferably comprising glass-fibre, such as glass fibre cloth, or mat, or non-woven fabric. The insertion of the reinforcing layer is accomplished by laying said cloth, mat or non-woven fabric onto the preformed shell intended to form the external layer or coating, after positioning it into its related half-mould, and by subsequently injecting the rigid two-component polyurethane after the split mould has been closed.

Thus, the following advantages can be secured:

— a self-supporting structure of low density, in particular in the 0.3 to 1.0 range, with attendant weight reduction for a given strength;

— a structure which is impervious to thermal stresses, indeformable, free of continuity defects such as may result from the presence of bubbles, blowholes, and the like;

— the possibility of eliminating metal, plastics, or the like material bracing inserts, as incorporated by co-moulding, and of including other inserts by fold-seaming the workpiece.

The invention will be next described in detail with reference to the accompanying drawings, given herein by way of example only and where:

Figure 1 is a partly sectional perspective view of an instrument panel according to the invention;

Figures 2 and 2*a* are a side elevation and a section view, as taken through a mould along the line II*a*—II*a*, respectively, illustrating the surface layer pre-forming step according to one embodiment of this manufacturing method;

Figures 3 and 3*a* are longitudinal section and cross-section views, respectively, of a mould, illustrating the subsequent steps of moulding the insert and simultaneously coupling it with the surface layer;

Figures 4 and 4*a* are side elevation and cross-sectional views, respectively, of the final product upon delivery; and

Figure 5 is a sectional view through a mould, as shown during the reinforcing layer insertion step.

Figure 1 of the drawings shown an instrument panel *P* formed in accordance with this invention, and including a rigid ins rt *I* and a soft surface layer *S* which make up said panel, said insert and layer being intimately int rconnected together in a manner which will be explained hereinafter. The insert *I* is made of a rigid polymeric material selected from a group including polypropylene and rigid polyurethane, and has such m chanical

features as can make it self-supporting, with the possible utilisation of auxiliary metal inserts.

The surface layer *S* is composed of a rolled half-layer formed from an ABS and PVC mixture, and from an either expanded PVC or cross-linked expanded polyethylene half-layer, such materials being perfectly recognisable by the expert through the above abbreviated definitions thereof. A preferred composition of the rolled half-layer may be, for example, the following: 100 parts PVC, 100 parts ABS, and 45 parts NBR, plus 100 parts of a plasticiser, all the amounts indicated being by weight. The half-layers are coupled together by rolling, following the tackifying of at least one of them, the whole in accordance with the procedure described in the cited patent application by this same Applicant. By virtue of its own characteristics, the surface layer *S* is heat-deformable, and this enables the instrument panel, or other comparable element, to be obtained through a specially simple and fast-rate manufacturing method which lends itself ideally to mass production techniques.

Figure 2 *et seq.* illustrate an embodiment of the above method which comprises the following steps. On a mould plug 10, there is laid the pre-heated surface layer *S*, which has previously formed on a continuous basis, e.g. with the process described in the cited prior patent application. By means of a pump 11, a vacuum is formed inside the mould plug, and owing to the provision of a plurality of holes through the surface of the latter, the surface layer is caused to adhere to the mould and conform to the profile thereof. The formed layer *S* is then transferred — as arranged with its expanded or foam half-layer in view — into the female mould 12 of a split mould 13 which is closed by a mould half 14 defining a gap or port in communication with an injection channel 15. The mould half 12 is thermally conditioned by means of a series of channels 16 through which a heated fluid is circulated, and is subjected to the action of a vacuum pump (not shown) which is connected to a fitting 17, the resulting vacuum ensuring a perfect adhesion of the layer *S* to the surface of the mould half 12. Through the channel 15, a rigid polyurethane mix is injected; the injection is carried out with a process known in the art as R.I.M. (Reaction Injection Moulding), thereby the insert *I* is formed by direct moulding which is intimately connected to the expanded half layer of the surface layer *S*.

After delivery and trimming of the edges *L* of the surface layer *S*, a finished product *P* is obtained as shown in Figures 4 and 4*a*.

According to a modified embodiment of the manufacturing method, the polypropylene insert *I* is form d first as by inj ction moulding. The resulting insert will be in the form of a patterned plate having a plurality of throughgoing holes. Then, that surfac of the insert is tackified which is intended for receiving the lay r *S*, through the use of a primer or flame application and polyurethan adhesive. Next, th lay r *S* — as produced separately — is appli d by vacuum forming utilising the insert itself as the mould plug for said surface layer. It will be necessary to previously h at the surfac layer and soft n it for adhesion to the mould plug.

In Figure 5, the reference numeral 100 designates a female mould half, and the character *S* designates a pre-formed shell adapted to form the exposed layer of the finished element. The shell *S* is produced at a previous processing step on a mould plug similar to the one described hereinabove.

After laying in the mould half 100 the shell *S* in the preformed condition mentioned above, with its in view surface contacting the surface of the mould half, a reinforcing layer *SR* is arranged to simply rest onto the shell, which is intended for incorporation to the polyurethane insert. The layer *SR* comprises of preference a material selected from a group icluding glass fibre cloth, glass fibre mat, glass fibre non-woven fabric, and the like. However, the exact nature of the layer *SR* is not critical, and satisfactory results have also been achieved through the use of synthetic and inorganic fibre based cloths, mats, and non-woven fabrics, as well as of a thin wire mesh.

The coverage of the layer *SR* will be commensured to the surface area, as developed flat, of the finished element, but said layer may also be just partial, such as to achieve a correspondingly partial stiffening of selected portions of the finished element.

After the split mould has been closed by superimposition with a mating mould half 200, the rigid polyurethane two-component mix is injected. After delivery and trimming of the edges of the surface layer, a finished element is produced which is characterised by considerable lightness, as resulting from that the inclusion of the layer *SR* provides a corresponding considerable reduction in the density of the polyurethane insert, which density would be in the 0.3 to 1.0 range. Notwithstanding that marked lightening of the element, the completed element still has improved mechanical strength and thermal characteristics, as well as substantial indeformability.

Moreover, the reinforced polyurethane construction allows the inclusion of any metal insert by direct fold seaming of the workpiece, thus avoiding the more complex co-moulding of the workpiece.

Of course, based on this same inventive principle, any implementation details of the method and embodiments of the resulting product may vary from the foregoing description and illustration given herein by way of example and not of limitation, without departing from the scope of the invention.

CLAIMS

1. A self-supporting lement, useful in the construction of motorvehicle body interiors, particularly in the form of an instrument panel, characterised in that it comprises, in intimate mutual interconnection, a self-supporting

polymeric insert and a soft surface layer including a heat-deformable laminate, in turn made up of a rolled half-layer and foam half-layer coupled together.

2. A self-supporting element according to Claim 1, wherein said insert and said surface layer are first produced separately and then coupled together by a moulding process.

3. A self-supporting element according to the preceding claims, wherein the insert is formed from a rigid polymeric material selected from a group including polypropylene and rigid polyurethane.

4. A self-supporting element according to the preceding claims, wherein the rolled half-layer of the surface layer is formed from a mixture of such materials as are known by the terms of ABS and PVC, and the foam half-layer is formed from either expanded PVC or polyethylene.

5. A self-supporting element according to Claim 1, characterised in that it includes, between the shell and structure, a reinforcing layer substantially and preferably comprising a layer of glass fibre such as glass fibre cloth, mat, or non-woven fabric.

6. A self-supporting element according to Claim 5, wherein said reinforcing layer comprises a synthetic fibre cloth, or mat, or non-woven fabric.

7. A self-supporting element according to Claim 5, wherein said reinforcing layer comprises a wire mesh.

8. A method of manufacturing a self-supporting element according to Claims 1 to 4, characterised in that it comprises the following steps:

heat forming under vacuum a surface layer on a mould plug;

transferring said preformed layer into a corresponding female mould; and

closing said mould, and forming said insert by direct injection of rigid polyurethane two-component material in accordance with the Reaction Injection Moulding (R.I.M.) procedure.

9. A method according to Claim 8, wherein the foam half-lay r and insert material are sealed to each other by adhesion during the injection step.

10. A method of manufacturing a self-supporting element according to Claims 1 to 4, characterised in that it comprises the following steps:

forming a polypropylene insert by injection moulding, said insert being in the form of a patterned plate provided with throughgoing holes;

tackifying, by means of a primer or by flame application and a polyurethane adhesive, that face of the insert which is intended for receiving the surface layer thereon; and

applying, by vacuum forming, a surface layer to said insert while utilising said insert as a mould plug for said surface layer.

11. A method of manufacturing a self-supporting element according to any of Claims 5 to 7, characterised in that it comprises the following steps:

heat forming under vacuum the surface shell on a mould plug;

transferring the preformed shell into a corresponding female mould;

positioning the reinforcing layer onto the shell; and

closing the mould and injecting rigid two-component polyurethane to thus form the self-supporting element with the incorporation of the material of said reinforcing layer.

12. A self-supporting element, useful in the construction of motor vehicle body interiors, substantially as herein described with reference to the accompanying drawings.

13. A method of manufacturing a self-supporting element, substantially as herein described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1982. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.